

Prevention of Osteoporosis

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Key concepts

For prevention of osteoporosis:

- Recommend adequate dietary intake of calcium and use supplements if necessary
- Advise on the role of vitamin D and consider sun exposure and the use of supplements if necessary
- Encourage regular weight bearing exercise
- Encourage smoking cessation
- Bisphosphonates can decrease the incidence of fracture in women with established osteoporosis

Osteoporosis is not just a result of ageing

Osteoporosis develops from a combination of the following factors:

- Age
- Genetics
- Lifestyle
- Hormones
- Medications
- Medical conditions

Age

Peak bone mass is achieved by around age 30–35 years and from then on starts to decline. The higher the peak bone mass achieved, the lower the impact of subsequent bone loss.

Genetics

Genes play a role in determining peak bone mass.

A person with a history of a hip fracture in a parent is at increased risk of osteoporosis. In addition, a study of hip fracture in New Zealand showed approximately 30% higher prevalence in people of European origin than for Māori, Pacific or Asian peoples. However, these may be due to differences in life expectancy and lifestyle factors relating to diet and body mass, as well as genetics.²

The relationship between body mass and osteoporosis is complex. Inherited muscular body mass appears to be protective whereas obesity may be a risk factor.³

Lifestyle

Lifestyle factors can have a direct effect on bone strength or alter calcium absorption. Factors associated with an increased risk of osteoporosis include, vitamin D deficiency, excess vitamin A, low calcium intake, smoking (both active and passive), high alcohol intake, lack of physical activity, immobilisation (paralysis, ill health), low body weight, exercise induced amenorrhoea and falls.

Hormones

Both men and women can develop osteoporosis but women are more at risk as their bones are smaller and there is an accelerated loss of bone density at menopause due to decreasing oestrogen. Early or surgical menopause or amenorrhoea increases the risk.

Any condition in men causing a decrease in testosterone can increase the risk.

Medications

Medications that can increase the risk of osteoporosis include:

- Steroids (>5mg/day for more than three months)
- Lithium
- Anticonvulsants
- Cancer chemotherapy drugs
- Depo-medroxyprogesterone (see BPJ 12)
- Proton pump inhibitors (see ETC, page 55)

Medical conditions

Many medical conditions are associated with osteoporosis either as a risk factor or consequence of (see Box 1).¹

Prevention of osteoporosis

Prevention of osteoporosis in the whole population focuses on nutritional and lifestyle changes. The goals include:

- Acquiring maximal peak skeletal bone mass
- Maintaining this bone mass for as long as possible

Increasing awareness of the modifiable risk factors for osteoporosis through patient education is an important primary care role. A recent study of attitudes and knowledge about osteoporosis in a group of well-educated New Zealand women did not show a high level of knowledge. Although most demonstrated high levels of health motivation and most considered osteoporosis to be a serious disease, the women had low perceptions of personal susceptibility.⁴

Box 1: Examples of medical conditions associated with osteoporosis¹

Endocrine e.g. diabetes mellitus, Cushing's syndrome, hyperparathyroidism, thyrotoxicosis

Gastrointestinal e.g. coeliac disease, inflammatory bowel disease, gastric bypass, pancreatic disease, malabsorption

Genetic e.g. cystic fibrosis, haemochromatosis, Marfan syndrome

Hypogonadal states e.g. premature ovarian failure

Haematologic e.g. multiple myeloma, haemophilia, leukaemia and lymphomas, thalassaemia

Rheumatic/autoimmune e.g. rheumatoid arthritis, ankylosing spondylitis, lupus

Other e.g. alcoholism, emphysema, end stage renal disease, prior fracture, anorexia nervosa, bulimia

Adequate calcium intake

Adequate calcium intake is necessary for the acquisition of peak bone mass by the age of 35 and its subsequent maintenance. When exogenous supply is inadequate, bone tissue is resorbed to maintain serum calcium at a constant level. Calcium needs vary throughout life and between genders (see Table 1).

Table 1: New Zealand recommended daily intake of calcium (mg/day)⁵

Children age 1–3	500
Children age 4–8	700
Children age 9–11	1000
Adolescents age 12–18	1300
Men 19–70	1000
Men 70+	1300
Women 19–54	1000
Pregnancy and Lactation	1000–1300
Post menopausal	1300

It is estimated that 20% of New Zealanders have an inadequate intake of calcium.⁶ Inadequate intake was higher amongst women and 15 to 18 year olds.

In these groups, low calcium intake puts them at particular risk. Calcium intake was also inadequate in low socioeconomic groups and Māori.

Practical food suggestions for maximising dietary calcium

Calcium is more easily absorbed from dairy products so these are the best source. In addition, some brands of orange juice, bread, cereals and soy based drinks are calcium-fortified. See Box 2 for examples of calcium rich foods.

Some ideas for adding calcium rich food to the diet could include:

- Choosing low fat milk instead of carbonated soft drinks
- Sprinkling grated low fat cheese on salad, soup or pasta
- Making fruit smoothies with low fat yoghurt
- Making toasties with wholemeal bread, sardines and low fat cheese
- Serving raw fruits and vegetables with a low fat yoghurt based dip
- Making a vegetable stir-fry and including diced tofu or low fat cheese
- Making desserts such as instant puddings or custard with low fat milk
- Serving fruit for dessert with low fat yoghurt or ice-cream
- Adding skim milk powder to mashed vegetables, baking, puddings and soups


For children who do not like drinking milk suggest:

- Grilled cheese on wholemeal toast fingers with marmite or vegemite
- Calcium fortified cereal with milk
- Baked beans sprinkled with grated cheese
- Cheese sauce over vegetables
- Mashed salmon and potato fish cakes

Box 2: Examples of calcium rich foods

Food type	Approximate calcium content (mg)
250mL milk	300
125g pottle yoghurt	200
40g (2–3 slices) cheddar cheese (N.B. softer cheeses have less calcium)	300
½ cup tofu	300
1 tin sardines (with bones)	300
100g canned pink salmon (with bones)	280
1 cup mussels	300
1 medium bowl fortified muesli	200
1 cup cooked broccoli	80
½ cup raw whole almonds	200
5 dried figs	190
1 cup baked beans	100

Adequate Vitamin D

 For more information see Best Tests – Vitamin D Testing in Primary Care, January 2007, www.bpac.org.nz keyword: vitaminD.

Vitamin D, which is produced in the skin, is essential for the acquisition and maintenance of bone mass.

Adequate exposure to sunlight is required to maintain vitamin D levels. This means about 15–20 minutes of sun exposure to the face and arms every day, avoiding sun exposure around midday in the summer. People with dark skin require approximately three to four times more exposure to gain the same benefit.

Although vitamin D is contained in some foods in small amounts such as oily fish (e.g. salmon, sardines, herring), adequate intake is not usually attained through diet alone.

Vitamin D deficiency is more prevalent in the following groups:

- Older people in residential care
- Older people admitted to hospital
- People with hip fracture
- People with dark skin
- People unable to obtain regular sun exposure

For these people, consider supplementation without testing. An appropriate dose is a single tablet of cholecalciferol 1.25mg monthly.

Regular exercise increases and maintains bone density

Regular weight bearing exercise should be recommended at all ages. This type of exercise can increase bone density and strength, particularly during childhood and adolescence. Exercise should be regular and ongoing as the beneficial effects on bone strength are lost when exercise is stopped.

Weight bearing exercise and muscle strengthening exercises may help prevent falls and fractures by improving agility, strength, co-ordination, posture and balance especially in older adults. Water exercise and cycling are regarded as non-weight bearing exercises but are still useful as muscle strength and fitness is maintained.

A person with established osteoporosis is at higher risk of fractures from high impact, jarring or twisting exercises such as running, jumping and aerobics.

Smoking is a significant risk factor for osteoporosis

There is some evidence that the significant risk of osteoporosis associated with smoking is a direct effect that is independent of confounding factors.⁷ Smoking cessation is recommended.

Avoid excessive alcohol

Current evidence about the role of alcohol and bone density is conflicting.⁸ Most publications report that an alcohol intake of three or more drinks per day is detrimental to bone density.¹ However, the exact mechanism of action remains unclear.

Fracture prevention in people with osteoporosis

The most common osteoporotic fracture sites are the spine, hip and wrist. They can have major consequences, for example hip fracture causes 10–20% excess mortality within one year and two and a half times increased risk of future fractures. In addition, after a hip fracture 20% of patients require long term residential care and only 40% fully regain their pre-fracture independence.¹

The consequences of spinal fracture can also be significant with chronic back pain, kyphosis, loss of height and limitation of activities that require bending, reaching and lifting. Multiple compression fractures result in an increasing curvature of the spine and

compression of thoracic and abdominal organs. This may then cause shortness of breath, stress incontinence, and gastrointestinal symptoms such as anorexia, constipation, distension and abdominal pain.

The focus for fracture prevention for people with osteoporosis is:

- Preventing falls
- Detection of osteoporosis
- Pharmaceutical interventions

Preventing falls

Preventing falls prevents fractures. Lowering the risk of falls may include checks on vision, hearing, adverse effects from medications, safety at home and promotion of exercise programmes.

Detection of osteoporosis

A clinical diagnosis of osteoporosis can be made if there is a low trauma fracture in an at-risk individual and may be suggested when an x-ray indicates low bone density. However the gold standard for diagnosis is bone densitometry (DEXA). Access to and funding of bone densitometry scanning varies throughout New Zealand.

Osteoporosis New Zealand Inc. recommends only measuring bone density when the result will impact on decision making.⁹

People who have had an osteoporotic fracture

A DEXA scan is not required for everyone with an osteoporotic fracture. Bisphosphonate treatment without the need for a prior DEXA scan can be considered for:

- Women over the age of 75 years who have had an osteoporotic fracture demonstrated on x-ray
- People who have had two or more demonstrated osteoporotic fractures
- People who have had systemic glucocorticoid steroid therapy (over 5mg per day prednisone equivalent for at least three months)

DEXA scanning

Bone densitometry (dual energy x-ray absorptiometry, DEXA) measures the bone mineral density usually at the hip and spine. Results may be given as a T score which is the result compared to “young normal” adults of the same sex or a Z score which is the result compared to that expected for the patient’s age and sex. The T score is most predictive of future fracture.

A DEXA scan is indicated for other people who have had an osteoporotic fracture.

People at high risk of osteoporosis

The contribution of individual risk factors towards the development of osteoporosis has not yet been quantified. Clinicians must make pragmatic decisions on who to refer for a DEXA scan based on major risk factors such as:¹⁰

- Age
- Female gender
- Low BMI
- Untreated premature menopause
- Family history of maternal hip fracture before the age of 75 years
- Conditions affecting bone metabolism (primarily inflammatory conditions, hyperthyroidism and prolonged immobility)
- Chronic steroid use

Criteria for alendronate

The current criteria for use of alendronate in osteoporosis are:

- History of one significant osteoporotic fracture demonstrated on x-ray and a documented T score ≤ -2.5
- History of one significant osteoporotic fracture demonstrated on x-ray, and either the patient is elderly, or DEXA scanning cannot be performed because of major logistical, technical or pathophysiological reasons
- History of two significant osteoporotic fractures demonstrated on x-ray
- Documented T score ≤ -3.0

The current criteria for use with glucocorticosteroid therapy are:

- Patient on systemic glucocorticosteroid therapy ($\geq 5\text{mg}$ per day prednisone equivalent) and where they have already received or expected to receive therapy for at least three months and either a T score of ≤ -1.5 or history of one significant osteoporotic fracture demonstrated on x-ray

Pharmacological treatment

Calcium supplements may be required when dietary calcium intake is inadequate. When used alone they are not recommended as adequate therapy for treating osteoporosis or reducing fracture risk. There have been concerns about increased cardiovascular risk associated with calcium supplementation (see BPJ 10). Calcium supplements should be used with caution in people aged over 70 years and in those with coronary heart disease. Dose may need to be reduced in those with a reasonable dietary intake of calcium.

Vitamin D supplements may be required in those who are likely to be deficient (see page 10). An appropriate dose is a single tablet of cholecalciferol 1.25mg monthly.

Activated vitamin D metabolites e.g. calcitriol, used as monotherapy, are thought to be inadequate and are no longer widely used.

Bisphosphonates. There is evidence that bisphosphonates reduce the risk of vertebral and hip fractures by 30 to 70% in women with established osteoporosis.¹¹ It appears that the effect of etidronate on non-vertebral fractures is less pronounced than alendronate. Etidronate is fully subsidised and alendronate is subsidised on special authority (see criteria on left).

Adequate vitamin D and calcium intake are considered prerequisites for bisphosphonate therapy.¹² The combination therapy Fosamax Plus contains a dose of vitamin D which is inadequate for treating vitamin D deficiency or preventing deficiency in high risk groups.¹³

Adverse effects of bisphosphonates may include gastrointestinal irritation and visual disturbances. There have been very rare reports of osteonecrosis of the jaw. However current evidence suggests that the risk of osteonecrosis, for people taking bisphosphonates for osteoporosis, is the same as that for the general population.¹⁴

Hormone Replacement Therapy is known to decrease the risk of fractures in post menopausal women but it is no longer regarded as first line for prevention or treatment of osteoporosis due to increased risk of cardiovascular events, thromboembolic events and breast cancer.

Further reading:

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